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(54) Improvements in or relating to printing plates.

(57) A plate is prepared by uniformly coating a substrate with a powdered material which is capable of being melted by the action of laser light. The plate is then image-wise exposed with a laser to melt the coating in selected areas. The exposed plate is used in lithographic printing plate manufacture. Thus the non-melted powder may be removed from the substrate to leave a lithographic printing image constituted by the laser light struck areas of the plate. Alternatively, the non-melted powder may be transferred and fixed to a transparent substrate which is then used to expose radiation sensitive material to form a lithographic printing plate.

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"IMPROVEMENTS IN OR RELATING TO PRINTING PLATES"

This invention relates to printing plates and more particularly, but not exclusively, concerns lithographic printing plates.

As is well known, the majority of lithographic printing plates in use at present are formed from radiation sensitive plates comprising a substrate, usually grained and anodised aluminium, coated with a layer of radiation-sensitive material which on exposure to radiation becomes either more or less soluble in a developer liquid. Conventionally, such plates are exposed to ultra-violet light beneath a positive or negative transparency so that parts of the coating are struck by the light and parts are not. The image-wise exposed coating is developed with a liquid developer which removes the more soluble parts of the coating to reveal the underlying surface of the substrate. The resultant lithographic printing plate has non-image areas constituted by the revealed substrate surface and a printing image constituted by the less soluble parts of the coating which remained on the substrate after the development step.

There is a trend towards more simplified plate systems in which a separate transparency and a liquid developer step are no longer required.

This trend is facilitated in accordance with the present invention which utilises, in lithographic printing plate manufacture, a plate which comprises a substrate uniformly coated with a powder which is capable of being melted by the action of laser light and which has been image-wise exposed to laser light to melt the powder in selected areas and leave non-melted powder in other areas.

According to an aspect of the present invention, there is provided a method of producing an image in printing plate manufacture which comprises providing a plate comprising a substrate having a uniform coating of a powder which is capable of being melted by the action of laser light; imagewise exposing the powder with laser light to melt the powder in selected areas; and removing the non-melted powder from the remaining areas of the substrate.

In one embodiment of the invention, the image fixed on the substrate is used as a lithographic printing image. In this case, the non-printing areas of the printing plate are constituted by the areas of the underlying substrate which are revealed when the powder is removed from said remaining areas. Printing is effected in known manner by applying an aqueous solution to the plate. The non-printing areas are hydrophilic and are wetted by the solution. However the resinous image is oleophilic and repels the water. Greasy lithographic printing ink isthen applied to the plate. The ink is accepted by the image but is repelled by the wet non-printing areas. The inked image is then contacted with the medium to be printed, usually via the intermediary of an offset blanket, so that ink is transferred from the image onto the medium to obtain the desired copies.

It is preferred for the imaged and decoated plate to be further heat treated to harden the image so as to improve printing life. If, however, the non-melted powder has not been fully removed from said remaining areas, the further heating step will cause any residual powder to adhere to the substrate. This residual powder will tend to accept ink and cause scumming during lithographic printing. This can be avoided by treating the substrate with a suitable protective layer forming material before it is coated with the powder. Examples of materials which

are suitable for this purpose are sodium dodecyl phenoxy benzene disulphonate; sodium salts of alkylated naphthalene sulphonic acids; the disodium salt of methylene dinaphthalene sulphonic acid; sodium dodecyl benzene sulphonate; and sodium salts of sulphonated alkyl diphenyl oxides.

Although the invention enables printing plates to be produced without using a liquid development step, it can if desired be utilised in the manufacture of lithographic printing plates by the conventional photomechanical technique. In accordance with this embodiment, the substrate carrying the laser melted image is used to form a transparency for use in exposing conventional radiation sensitive plates. This is particularly advantageous in, for example, the newspaper industry where a number of identical plates are required. In one form of this embodiment, the reversed image constituted by the non-melted powder may be transferred onto a transparent substrate e.g. a film and the transferred powder heated e.g. by infra-red heating to fix the reversed image to the transparent substrate. Then a radiation sensitive material is exposed to radiation through the transparent substrate and the exposed radiation sensitive material is developed to obtain the desired lighographic printing plate in conventional manner. The transfer of the non-melted powder may be effected by contacting the coating, after the exposure to laser light, with a transparent substrate having an adhesive surface or which has been electrostatically charged. In another form of this embodiment, the transparent substrate may be in the form of a film which is placed over the powder coating of the plate prior to exposure to the laser. The powder is then exposed to the laser light through the film. The melted powder tends to adhere to the film. Thus, on separation of the plate and the film, the plate carries an image

constituted by the non-melted powder and the film carries an image constituted by the melted powder. One of the images is a positive and the other is a negative.

The powder advantageously has a particle size of about 15 to 20 microns and is basically composed of a resin which has a melting-point sufficiently low to enable it to be readily melted by the laser but which is sufficiently hard at room temperature to remain particulate. Suitable resins are polyacrylates, polyesters, polystyrene, polyurethanes, epoxide resins , and styrene-acrylate copolymers. To improve the heat absorbance, the powder may include a pigment such as carbon black and to improve the heat transfer the powder may include thermally conductive material such as iron oxide or graphite. The powder may be sprayed onto the substrate and it is particularly preferred for the powder to be electrostatically charged before applying it to the substrate. In this way electrostatic forces retain the powder on the substrate until the exposure step and allow those areas which have not been subjected to laser light during exposure to be readily removed by, for example, a stream of air. Alternatively, the powder may be applied by means of a magnetic brush in which case the powder must contain a magnetic component, such as iron filings.

According to a further aspect of the present invention, there is provided an apparatus for producing an image in printing plate manufacture which comprises a means for applying a powder, which is capable of being melted by the action of laser light, to a substrate to form a uniform coating of the powder on the substrate; a laser for image-wise exposing the coated substrate so as to melt the powder in those areas which are to form the image; and means for removing the powder from the remaining areas of the substrate.

In a further embodiment, the apparatus also includes means for heating the exposed and decoated plate to further harden the image areas.

Preferably the powder applying means comprises a device for electrostatically charging and spraying the powder on the substrate or a magnetic brush.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example to the accompanying drawings, in which :-

Figure 1 is a schematic illustration of a first apparatus for use in carrying out the present invention, and

Figure 2 is a schematic illustration of a second apparatus for use in carrying out the present invention.

Referring to Figure 1, the apparatus includes a coating station 10, an exposure station 20, and a decoating station 30. A means is provided to convey a substrate 1 from a storage stack 2 of such substrates along a path through the apparatus such that it is subjected to processing operations at stations 10,20 and 30.

Coating station 10 includes a powder spray head 11 fed from a reservoir 12 and incorporating a high voltage source 13.

The exposure station 20 includes a laser exposure unit 21 comprising a laser 22, the output beam of which is controlled by a digital modulator 23 and a scanning device 24 in accordance with a digital signal produced by an analogue/digital converter 25. The laser exposure unit may vary in known ways and for further details reference may be made to "High Speed Laser Printing" by K.Starkweather in volume 4 of Laser Applications, edited by Joseph W. Goodman and Monte Ross and published by Academic Press. In this example the laser is a YAG-Nd (yttrium-aluminium

-garnet doped with neodymium) emitting at a wavelength of 1.06 micron. However other lasers, such as a carbon dioxide laser or an argon ion laser may be used.

The decoating station 30 includes an air knife 31 and a powder recovery system 32 in communication with the reservoir 12.

In use, a substrate 1, preferably formed of grained and anodised aluminium, is transferred from the stack 2 and conveyed to coating station 10. Powder is blown from reservoir 12 to the sprayhead 11 where it is electrostatically charged by the voltage source 13 and sprayed onto the substrate to form a thin uniform powder coating on the substrate. The coated substrate is then conveyed to the exposure station 20 where the coating is image-wise exposed to the laser light so that the powder is melted in the image areas and adheres to the substrate in those areas. The image-wise exposed substrate is then conveyed to the decoating station 30 where it travels slowly under the air knife 31 which removes the powder from the areas which were not exposed to the laser light. This powder is sucked up by the recovery system 32 and returned to the reservoir 12. The image-wise exposed and decoated substrate can then be used as a lithographic printing plate with the image constituting the printing image and the revealed surface of the substrate constituting the non-printing areas.

Other features may be incorporated into the apparatus if desired. For example, it is possible to include means, such as infra-red emitters or a hot air oven, for heating the decoated plate to further harden the image. Means for gumming the plate may also be incorporated.

Referring to Figure 2, the apparatus comprises a coating station 100, an exposure station 200 and a decoating station 300. As is shown, however, the substrate 1 is conveyed between the stations by being mounted on a drum 50.

In this embodiment the coating station 100 consists of a magnetic brush comprising a roller 101, containing a bar magnet 102, and rotating in a trough 103. The trough 103 contains a mixture of the powder and iron filings. The roller picks up the powder mixture and the powder is transferred to the substrate 1 because of a bias voltage applied between the roller and a connector plate 104 mounted in the drum 50. The bias voltage is selected such that the powder is transferred to the substrate and the iron filings are retained on the roller.

The exposure station200 is identical to that shown in Figure 1.

The decoating station comprises a rotating brush which is movable from an in-operative position (as shown) to an operative position in which it is in contact with the drum 50.

In use, a substrate is mounted on the drum and is then rotated past the magnetic brush roller 101 whereupon powder is transferred to the substrate. The substrate then passes the exposure station 200 where the powder forming the image areas is fused to the substrate. The brush at the decoating station 300 is retained in its inoperative position and the substrate is conveyed past the coating station where the majority of the powder is removed by reversing the bias voltage between the substrate and the roller. The decoating station brush is moved into its operative position to remove any residual toner.

As in the case of the Figure 1 embodiment, features such as heating means and gumming means may be incorporated.

The following Examples illustrate the invention:

EXAMPLE 1

A grained and anodised sheet of aluminium was processed by an apparatus as described and shown in Figure 1. The powder had a particle size of 15 micron and was a combination of carbon black and a styrene-acrylate co-

polymer having a melting point of 80 deg.C. The laser was a YAG-Nd laser having a power output of 10 watts. The exposed and decoated plate was used as a lithographic printing plate and it produced many satisfactory copies.

EXAMPLE 2

Example 1 was repeated except that the substrate, before the powder coating step, was treated with sodium dodecyl di-sulphonated diphenyl oxide in the manner described in U.K.Patent No.1513368 and that the image wise exposed substrate was further heated using infra-red emitters after decoating. A substantial increase in the print-life of the resultant lithographic plate was obtained.

EXAMPLE 3

A grained and anodised sheet of aluminium was processed in the apparatus of Figure 2. The powder had a particle size of 20 μ and was composed of graphite and a polyurethane resin having a melting point of 100°C. The powder was admixed with iron filings in a ratio of 5% powder to 95% iron filings. The laser was an argon ion laser having a power output of 12 watts. The image constituted by the melted powder was used as a lithographic printing image and good quality copies were obtained.

EXAMPLE 4

Example 1 was repeated except that after exposure a polyethylene terephthalate film which had been electrostatically charged by means of a corona discharge was pressed into contact with the powder layer and then stripped off. The non-melted areas of the powder coating adhered to the film. There was then obtained a positive image on the aluminium sheet and a negative image on the transparency. The aluminium sheet could be used as a lithographic printing plate. The transparency was subjected to infra-red heating to fix the powder thereon and could then be used to expose a radiation sensitive plate for conventional lithographic printing plate manufacture.

EXAMPLE 5

A grained and anodised sheet of aluminium was coated with powder as in Example 1. Before exposure to laser light, the powder was covered with a film of polyethylene terephthalate. The laser was arranged to expose non-image areas of the powder and, after the exposure step, the film was peeled off from the sheet. Those areas of the powder which had been melted by the laser had adhered to the film to form a negative transparency leaving a positive image consisting of non-melted powder on the sheet. The sheet was heated in an oven to fuse and fix the powder to the sheet to form a lithographic printing plate. By arranging the laser to expose image areas, a positive transparency could be produced for use in exposing a radiation sensitive plate in conventional lithographic printing plate manufacture.

CLAIMS:

1. The use in lithographic printing plate manufacture of a plate which comprises a substrate uniformly coated with a powder capable of being melted by the action of laser light and which has been image-wise exposed to laser light to melt the powder in selected areas and leave non-melted powder in other areas.

2. A method of producing a lithographic printing plate characterised in that it comprises providing a plate comprising a substrate having a uniform coating of a powder which is capable of being melted by the action of laser light; placing a transparent substrate over the coating of powder; image-wise exposing the powder with laser light to melt the powder in selected areas and cause the melted powder to adhere to the transparent substrate; separating the substrates; exposing radiation sensitive material through the transparent substrate; and developing the exposed radiation sensitive material to obtain the desired lithographic printing plate.

3. A method of producing an image in printing plate manufacture characterised in that it comprises providing a plate comprising a substrate having a uniform coating of powder which is capable of being melted by the action of laser light; image wise exposing the powder with laser light to melt the powder in selected areas; and removing the non-melted powder from the remaining areas of the substrate.

4. A method according to claim 2 or 3 wherein the powder comprises a resin

5. A method according to claim 4 wherein the resin is a polyacrylate, a polyester, a polystyrene, a polyurethane, an epoxide resin, or a styrene/acrylate copolymer.

6. A method according to claim 4 or 5 wherein the powder comprises a pigment in admixture with said resin.

7. A method according to claim 6 wherein the pigment is black.

8. A method according to any one of claims 2 to 7 wherein the substrate of the plate is coated with a protective layer forming material before being coated with the powder.

9. A method according to claim 8 wherein the plate is heated after the non-melted powder has been removed.

10. A method of producing a lithographic printing plate in accordance with claim 3 or anyone of claims 4 to 9 when appendant thereto wherein the non-melted powder is transferred onto a transparent substrate; the transferred powder is heated to fix it to the transparent substrate; a radiation sensitive material is exposed to radiation through the transparent substrate; and the exposed radiation sensitive material is developed to obtain the desired lithographic printing plate.

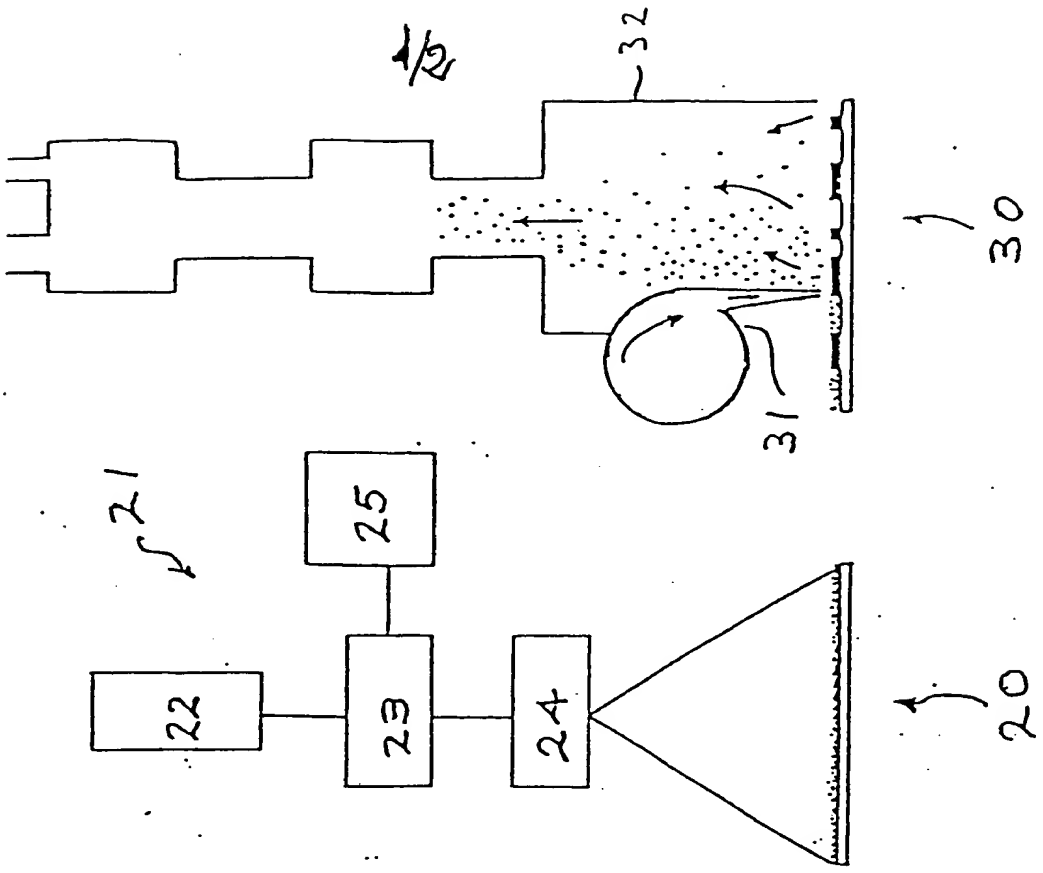
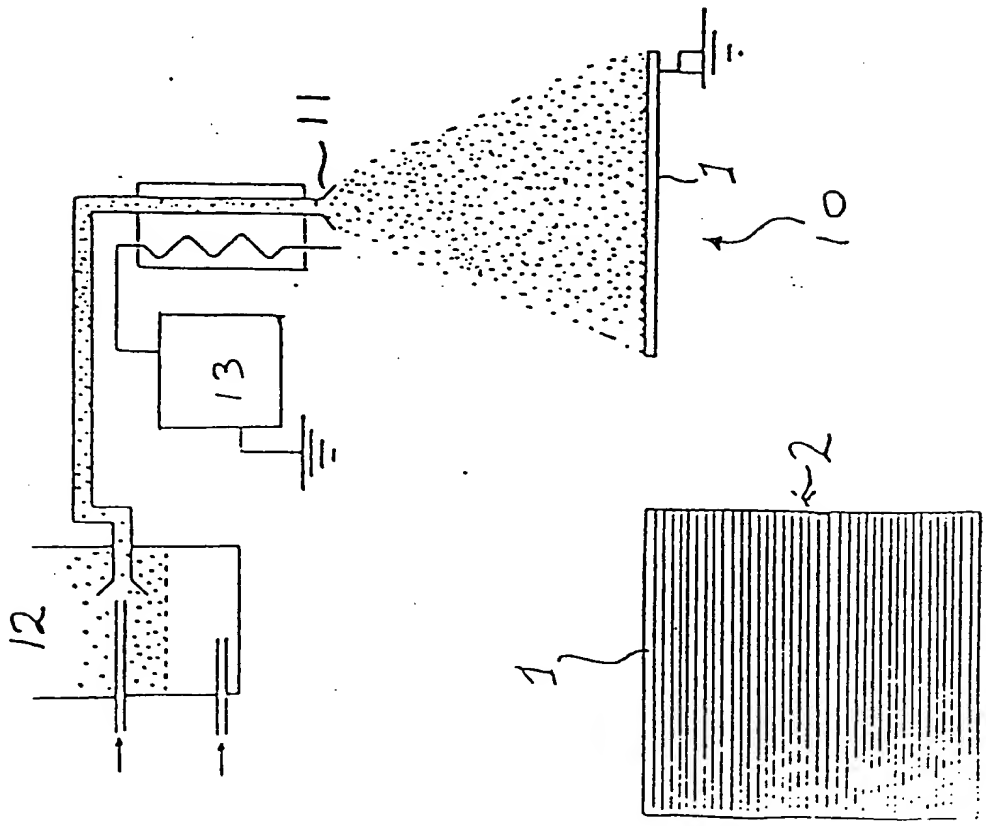


FIG 1



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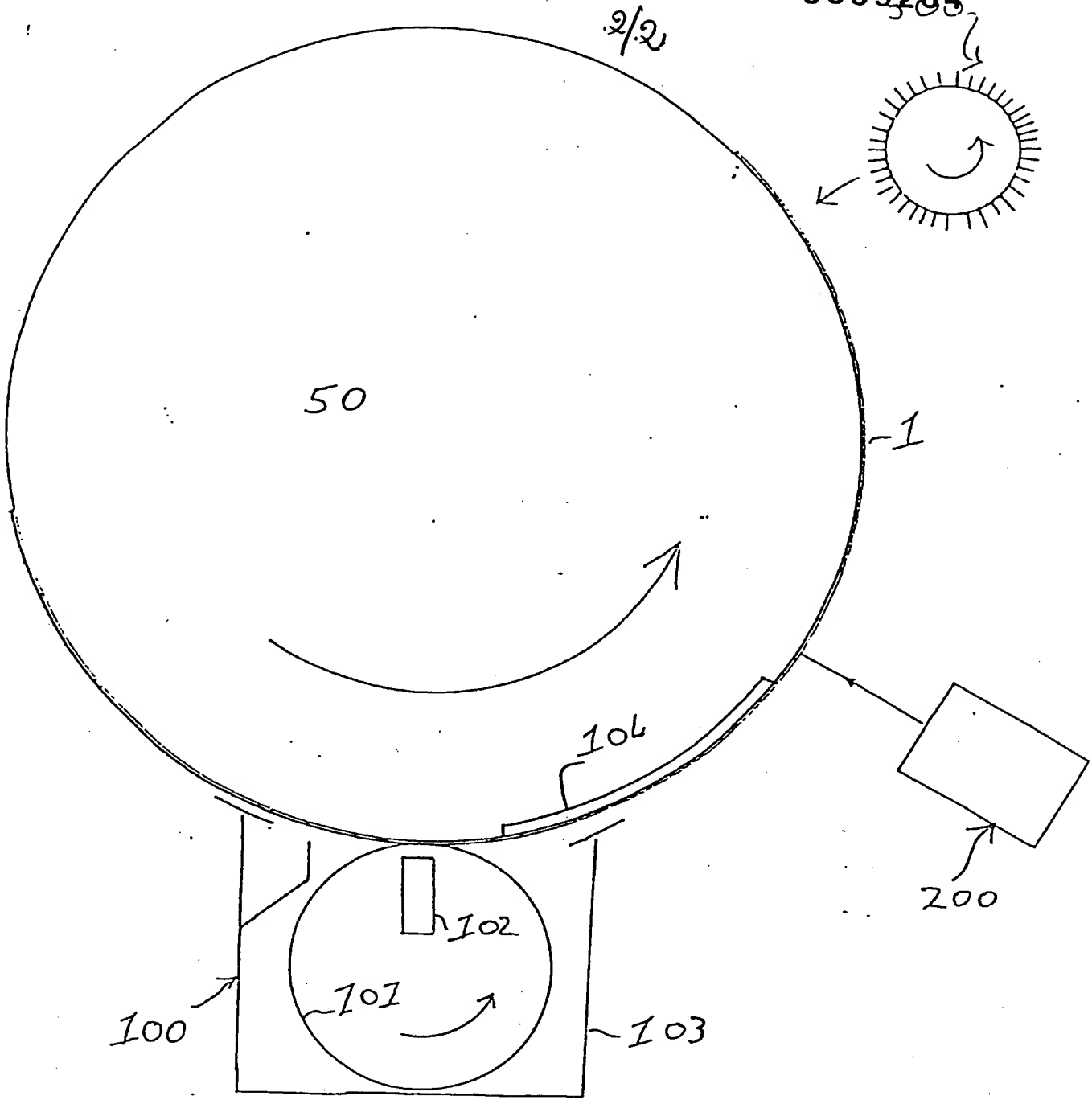

FIG. 2